

4 M is ruthenium or osmium;
5 X and X¹ are each independently an anionic ligand;
6 L is a neutral electron donor ligand; and,
7 R, R¹ R⁶, R⁷, R⁸, and R⁹ are each independently hydrogen or a substituent selected from
8 the group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀ alkynyl, aryl, C₁-C₂₀
9 carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyoxy, aryloxy, C₂-C₂₀
10 alkoxycarbonyl, C₁-C₂₀ alkylthiol, aryl thiol, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
11 alkylsulfinyl, the substituent optionally substituted with one or more moieties selected
12 from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, aryl, and a functional group
13 selected from the group consisting of hydroxyl, thiol, thioether, ketone, aldehyde, ester,
14 ether, amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate, isocyanate,
15 carbodiimide, carboalkoxy, carbamate, and halogen.

1 3. (Original) The method of Claim 2 wherein:

2 M is ruthenium;
3 L is selected from the group consisting of phosphine, sulfonated phosphine, phosphite,
4 phosphinite, phosphonite, arsine, stibine, ether, amine, amide, imine, sulfoxide, carboxyl,
5 nitrosyl, pyridine, and thioether; and,

6 X and X¹ are each independently hydrogen, halide, or a substituent selected from the
7 group consisting of C₁-C₂₀ alkyl, aryl, C₁-C₂₀ alkoxide, aryloxide, C₃-C₂₀ alkyldiketonate,
8 aryl diketonate, C₁-C₂₀ carboxylate, arylsulfonate, C₁-C₂₀ alkylsulfonate, C₁-C₂₀
9 alkylthiol, aryl thiol, C₁-C₂₀ alkylsulfonyl, and C₁-C₂₀ alkylsulfinyl, the substituent
10 optionally substituted with one or more moieties selected from the group consisting of
11 C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, aryl and halide.

1 4. (Original) The method of Claim 3 wherein:

2 M is ruthenium;
3 X and X¹ are each independently selected from the group consisting of halide, CF₃CO₂,
4 CH₃CO₂, CFH₂CO₂, (CH₃)₃CO, (CF₃)₂(CH₃)CO, (CF₃)(CH₃)₂CO, PhO, MeO, EtO,
5 tosylate, mesylate, and trifluoromethanesulfonate;

6 L is a phosphine of the formula $PR^3R^4R^5$, where R^3 , R^4 , and R^5 are each independently
7 aryl, C_1 - C_{10} alkyl, or cycloalkyl;

8 R is hydrogen; and,

9 R^1 is phenyl or vinyl, optionally substituted with one or more moieties selected from the
10 group consisting of C_1 - C_5 alkyl, C_1 - C_5 alkoxy, phenyl, and a functional group selected
11 from the group consisting of hydroxyl, thiol, thioether, ketone, aldehyde, ester, ether,
12 amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate, isocyanate,
13 carbodiimide, carboalkoxy, carbamate, and halogen.

1 5. (Original) The method of Claim 4 wherein

2 X and X^1 are each chloride;

3 L is selected from the group consisting of $-P(cyclohexyl)_3$, $-P(cyclopentyl)_3$, -
4 $P(isopropyl)_3$, and $-P(phenyl)_3$; and,

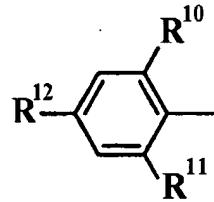
5 R^1 is phenyl or $-C=C(CH_3)_2$.

1 6. (Original) The method of Claim 5 wherein R^6 and R^7 together form a cycloalkyl or an
2 aryl.

1 7. (Original) The method of Claim 5 wherein R^6 and R^7 are the same and are hydrogen or
2 phenyl.

1 8. (Original) The method of Claim 5 wherein R^8 and R^9 are each independently a substituted
2 or unsubstituted aryl.

1 9. (Original) The method of Claim 5 wherein R^8 and R^9 are each independently of the
2 formula

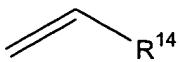


3
4 wherein

5 R¹⁰, R¹¹, and R¹² are each independently hydrogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, aryl, or a
6 functional group selected from hydroxyl, thiol, thioether, ketone, aldehyde, ester, ether,
7 amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate, isocyanate,
8 carbodiimide, carboalkoxy, carbamate, and halogen.

1 10. (Original) The method of Claim 9 wherein R¹⁰, R¹¹, and R¹² are each independently
2 hydrogen, methyl or isopropyl.

1 11. (Original) The method of Claim 1 wherein the terminal olefin is of the formula:



2 3 wherein R¹⁴ is selected from the group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀
4 alkynyl, aryl, C₁-C₂₀ carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyloxy,
5 aryloxy, C₂-C₂₀ alkoxycarbonyl, C₁-C₂₀ alkylthio, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
6 alkylsulfinyl; and wherein R¹⁴ is substituted or unsubstituted.

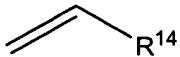
1 12. (Original) The method of Claim 11 wherein R¹⁴ is substituted with one or more moieties
2 selected from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy and aryl, wherein the
3 moiety is substituted or unsubstituted.

1 13. (Original) The method of Claim 12 wherein the moiety substitution is selected from the
2 group consisting of halogen, a C₁-C₅ alkyl, C₁-C₅ alkoxy, and phenyl.

1 14. (Original) The method of Claim 11 wherein R¹⁴ contains one or more functional groups,
2 wherein the functional group is selected from the group consisting of hydroxyl, thiol,
3 thioether, ketone, aldehyde, ester, ether, amine, imine, amide, nitro, carboxylic acid,
4 disulfide, carbonate, isocyanate, carbodiimide, carboalkoxy, carbamate, and halogen.

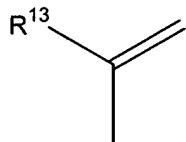
1 15. (Currently amended) The method of Claim 11 wherein the terminal olefin is of the
2 formula:

3
4



6 wherein R¹⁴ is a functional group selected from the group consisting of hydroxyl, thiol,
7 thioether, ketone, aldehyde, ester, ether, amine, imine, amide, nitro, carboxylic acid,
8 disulfide, carbonate, isocyanate, carbodiimide, carboalkoxy, carbamate, and halogen,
9 wherein the functional group is substituted or unsubstituted.

1 16. (Original) The method of Claim 1 wherein the geminal disubstituted olefin is of the
2 formula



4 wherein R¹³ is selected from the group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀
5 alkynyl, aryl, C₁-C₂₀ carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyoxy,
6 aryloxy, C₂-C₂₀ alkoxycarbonyl, C₁-C₂₀ alkylthio, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
7 alkylsulfinyl; and wherein R¹³ is substituted or unsubstituted.

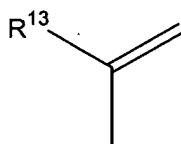
1 17. (Original) The method of Claim 11 wherein R¹³ is substituted with one or more moieties
2 selected from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy and aryl, wherein the
3 moiety is substituted or unsubstituted.

1 18. (Original) The method of Claim 12 wherein the moiety substitution is selected from the
2 group consisting of halogen, a C₁-C₅ alkyl, C₁-C₅ alkoxy, and phenyl.

1 19. (Currently amended) The method of Claim 11 16 wherein R¹³ contains one or more
2 functional groups, wherein the functional group is selected from the group consisting of

3 hydroxyl, thiol, thioether, ketone, aldehyde, ester, ether, amine, imine, amide, nitro,
4 carboxylic acid, disulfide, carbonate, isocyanate, carbodiimide, carboalkoxy, carbamate,
5 and halogen.

1 20. (Currently amended) The method of Claim 11 wherein the geminal disubstituted olefin
2 is of the formula



3
4 wherein R^{13} is a functional group selected from the group consisting of hydroxyl, thiol,
5 thioether, ketone, aldehyde, ester, ether, amine, imine, amide, nitro, carboxylic acid,
6 disulfide, carbonate, isocyanate, carbodiimide, carboalkoxy, carbamate, and halogen,
7 wherein the functional group is substituted or unsubstituted.

1 21. (Original) The method of Claim 1 wherein the disubstituted olefin is a substituted or
2 unsubstituted α - functionalized olefin.

1 22. (Original) The method of Claim 21 wherein the α - functionalized olefin is a substituted or
2 unsubstituted acrylamide.

1 23. (Original) The method of Claim 21 wherein the α - functionalized olefin is selected from
2 the group consisting of a substituted or unsubstituted acrylate, vinyl ketone, and vinyl
3 aldehyde.

1 24. (Cancelled)

1 25. (Original) The method of Claim 1 wherein the trisubstituted olefin is prepared at room
2 temperature.

1 26. (Currently amended) A method for preparing di- or tri-substituted olefins comprising
2 contacting a first substituted or unsubstituted electron deficient olefin with a second
3 substituted or unsubstituted electron deficient olefin in the presence of a metal carbene
4 metathesis catalyst, wherein the first and second olefins are the same or different, to
5 generate a di- or tri-substituted olefin in an intramolecular olefin cross-metathesis
6 reaction.

1 27. (Original) The method of Claim 26 wherein the first olefin is a substituted or
2 unsubstituted styrene and wherein the second olefin contains an α - carbonyl group.

1 28. (Original) The method of Claim 27 wherein the second olefin is acrylate or acrylamide,
2 and wherein the second olefin is substituted or unsubstituted.

1 29. (Original) The method of Claim 26 wherein the first and second olefins each contain an
2 α - carbonyl group.

1 30. (Original) The method of Claim 26 wherein the first olefin is a substituted styrene and
2 wherein the substitution occurs on one or more aromatic carbons.

1 31. (Original) The method of Claim 26 wherein the first olefin is a substituted styrene and
2 wherein the substitution occurs on the olefinic carbons.

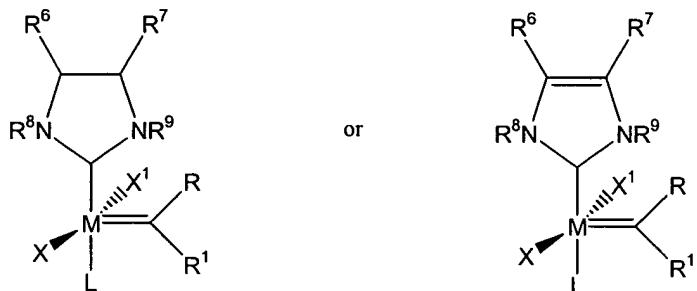
1 32. (Original) The method of Claim 26 wherein the first olefin is an ortho-substituted styrene.

1 33. (Original) The method of Claim 26 wherein the first olefin is a terminal olefin and
2 wherein the second olefin is an α -functionalized olefin.

1 34. (Currently amended) A method for preparing di- or tri-substituted olefins comprising
2 contacting a substituted or unsubstituted aliphatic olefin with a substituted or
3 unsubstituted electron-deficient olefin in the presence of a metal carbene metathesis

4 catalyst to generate a di- or tri-substituted olefin in an intermolecular olefin cross-
5 metathesis reaction.

1 35. (Original) The method of Claim 34 wherein the metathesis catalyst is of the formula
2
3



5 wherein:

6 M is ruthenium;

7 X and X¹ are each independently selected from the group consisting of halide, CF₃CO₂,
8 CH₃CO₂, CFH₂CO₂, (CH₃)₃CO, (CF₃)₂(CH₃)CO, (CF₃)(CH₃)₂CO, PhO, MeO, EtO,
9 tosylate, mesylate, and trifluoromethanesulfonate;

10 L is a phosphine of the formula PR³R⁴R⁵, where R³, R⁴, and R⁵ are each independently
11 aryl, C₁-C₁₀ alkyl, or cycloalkyl;

12 R is hydrogen; and,

13 R¹ R⁶, R⁷, R⁸, and R⁹ are each independently hydrogen or a substituent selected from the
14 group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀ alkynyl, aryl, C₁-C₂₀
15 carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyoxy, aryloxy, C₂-C₂₀
16 alkoxycarbonyl, C₁-C₂₀ alkylthiol, aryl thiol, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
17 alkylsulfinyl, the substituent optionally substituted with one or more moieties selected
18 from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, aryl, and a functional group
19 selected from the group consisting of hydroxyl, thiol, thioether, ketone, aldehyde, ester,
20 ether, amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate, isocyanate,
21 carbodiimide, carboalkoxy, carbamate, and halogen.

1 36. (Original) The method of Claim 34 wherein the aliphatic olefin is a mono-, di- or
2 trisubstituted olefin.

1 37. (Original) The method of Claim 34 wherein the aliphatic olefin is substituted one or more
2 groups selected from the group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀
3 alkynyl, aryl, C₁-C₂₀ carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyloxy,
4 aryloxy, C₂-C₂₀ alkoxy carbonyl, C₁-C₂₀ alkylthio, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
5 alkylsulfinyl, wherein the substituent group is substituted or unsubstituted.

1 38. (Original) The method of Claim 37 wherein the substituent group is substituted with one
2 or more moieties selected from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, and
3 aryl, wherein the moiety is substituted or unsubstituted.

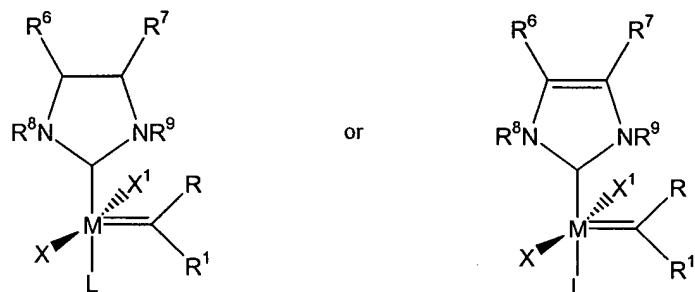
1 39. (Original) The method of Claim 38 wherein the moiety is substituted with one or more
2 groups selected from a halogen, a C₁-C₅ alkyl, C₁-C₅ alkoxy, and phenyl.

1 40. (Original) The method of Claim 34 wherein the aliphatic olefin includes one or more
2 functional groups selected from the group consisting of hydroxyl, thiol, thioether, ketone,
3 aldehyde, ester, ether, amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate,
4 isocyanate, carbodiimide, carboalkoxy, carbamate, and halogen.

1 41. (Original) The method of Claim 34 wherein the aliphatic olefin is 1-hexene and the
2 electron-deficient olefin is methyl acrylate.

1 42. (Original) A method for preparing trisubstituted olefins comprising contacting a first
2 substituted or unsubstituted styrene with a second substituted or unsubstituted α -
3 functionalized olefin in the presence of a metathesis catalyst to form a cross-product and
4 stilbene, and contacting the stilbene with unsubstituted α -functionalized olefin in the
5 presence of a metathesis catalyst, wherein the catalyst is of the formula:

6



7 wherein:

8 M is ruthenium;

9 X and X¹ are each independently selected from the group consisting of halide, CF₃CO₂,
10 CH₃CO₂, CFH₂CO₂, (CH₃)₃CO, (CF₃)₂(CH₃)CO, (CF₃)(CH₃)₂CO, PhO, MeO, EtO,
11 tosylate, mesylate, and trifluoromethanesulfonate;

12 L is a phosphine of the formula PR³R⁴R⁵, where R³, R⁴, and R⁵ are each independently
13 aryl, C₁-C₁₀ alkyl, or cycloalkyl;

14 R is hydrogen; and,

15 R¹ R⁶, R⁷, R⁸, and R⁹ are each independently hydrogen or a substituent selected from the
16 group consisting of C₁-C₂₀ alkyl, C₂-C₂₀ alkenyl, C₂-C₂₀ alkynyl, aryl, C₁-C₂₀
17 carboxylate, C₁-C₂₀ alkoxy, C₂-C₂₀ alkenyloxy, C₂-C₂₀ alkynyloxy, aryloxy, C₂-C₂₀
18 alkoxycarbonyl, C₁-C₂₀ alkylthiol, aryl thiol, C₁-C₂₀ alkylsulfonyl and C₁-C₂₀
19 alkylsulfinyl, the substituent optionally substituted with one or more moieties selected
20 from the group consisting of C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, aryl, and a functional group
21 selected from the group consisting of hydroxyl, thiol, thioether, ketone, aldehyde, ester,
22 ether, amine, imine, amide, nitro, carboxylic acid, disulfide, carbonate, isocyanate,
23 carbodiimide, carboalkoxy, carbamate, and halogen.

1 Claims 43-45 (Cancelled)